

# The Sustainable Business Model of a Comprehensive Biomass Company

The Nippon Paper Group is a comprehensive biomass company that, while sustainably managing forests, effectively uses and recycles the abundant biomass resources they produce. We practice CSR activities consistent with our business characteristics and business strategies.

Helping to fight global warming, protect biodiversity, and prevent resource depletion

**Three** Cycles Contributing to Sustainable Development

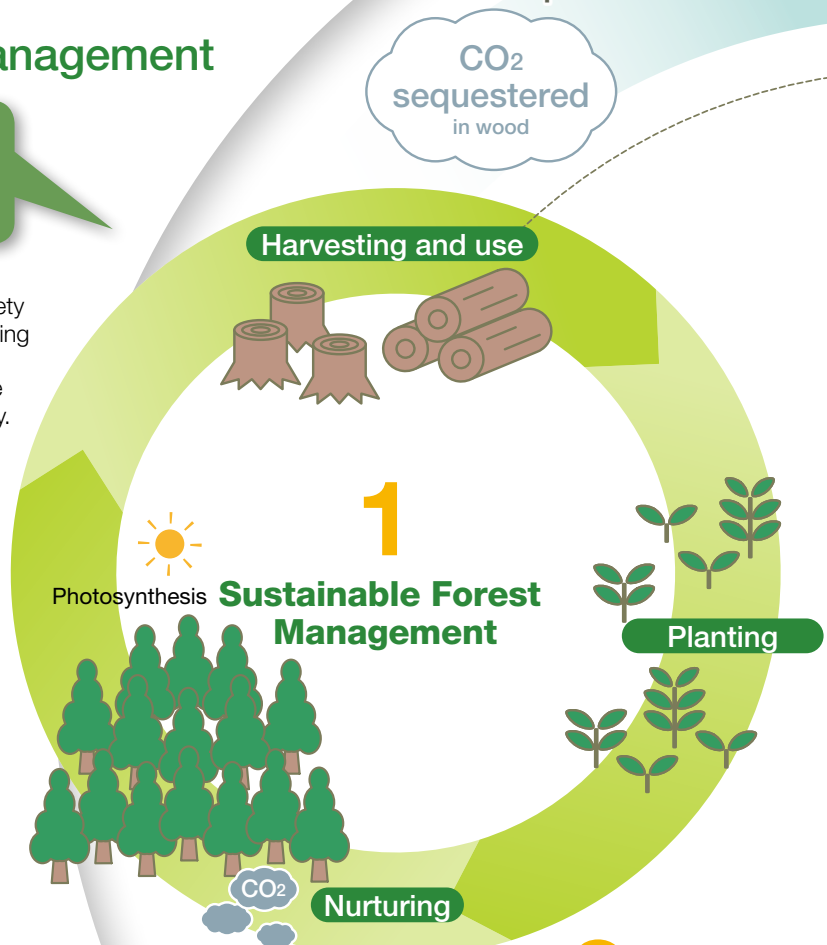
## 1 Sustainable Forest Management

**181** thousand hectares of company-owned forests worldwide

In addition to preventing global warming and protecting watersheds, forests perform a wide variety of functions such as providing shelter for diverse living creatures. After harvesting, steps such as tree planting are taken to regenerate forests and ensure that forests under our stewardship thrive indefinitely.

**Preserving biodiversity**  
Nippon Paper Industries has designated approximately 20% of its Japanese forest as "environmental forest areas." In these areas, logging for commercial purposes is prohibited and forest ecosystems and water resources are protected. These environmental forest areas include national park lands in Akan, Nikko, and other places as well.

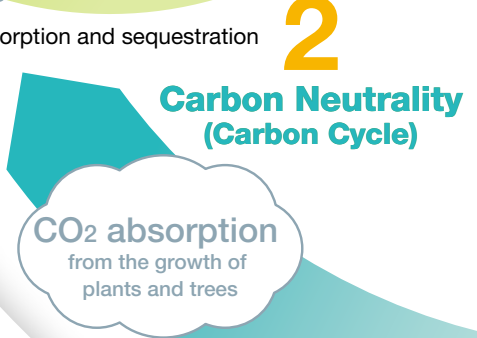
**Environmental forest areas:**  
**18** thousand hectares  
About 20% of forests owned in Japan



## 2 Carbon Neutrality (Preventing Global Warming through the Carbon Cycle)

**CO2 sequestered in company-owned forests worldwide:** **33** million tons

Trees, the principal raw material used by the Nippon Paper Group, absorb and hold CO<sub>2</sub> from the atmosphere as they grow. It is believed, therefore, that the release of CO<sub>2</sub> when wood resources are burned results in no net increase in atmospheric CO<sub>2</sub>. The ongoing effective use of wood resources from properly managed, sustainable forests constitutes a carbon-neutral cycle that adds no carbon to the atmosphere.



## Toward greater use of trees

Wood science technologies

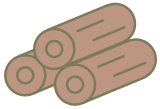


Woody biomass resources

New business creation  
Expansion of product applications to growth areas

### Cascade use of wood

#### Unprocessed wood



#### Use as a material

Paper and construction materials and various other products



CO<sub>2</sub> emission from burning

#### Use as a fuel

Black liquor, construction waste, logging residue, and other forms of biomass fuel



Use

3

### Recycling of Paper Products

Separation and collection

Production of recycled paper

Pulp production from wastepaper

## Making full use of trees as a biomass resource

### Cascade use of wood

While constantly building upon its wealth of wood science technologies, the Nippon Paper Group uses every harvested tree in a cascade of applications.

### Prevention of resource depletion

Of the energy used by the Nippon Paper Group, 46% is comprised of black liquor from the pulp-making process, wood construction waste and other biomass fuels, and fuels derived from discarded tires, RPF, and other waste materials.

The Group is also making advances in the development of biomass fuel that can be used in place of fossil fuels.

### Non-fossil energy\* as a percent of total energy usage:

46%

\* Non-fossil energy = biomass energy+ waste energy

## 3 Recycling of Paper Products

### Recycled paper utilization rate

Paper **38%** Paperboard **89%**

The Nippon Paper Group is working diligently to increase the waste paper collection rate with the support of customers and the general public. In addition to bolstering its recycled paper processing capabilities, the Group is striving to expand the range of applications for pulp made from wastepaper.

# Targeting New Value through Our R&D and Business Strategy

The Nippon Paper Group is creating new value as a comprehensive biomass company shaping the future with trees.

Message

## R&D Activities Targeting Long-Term Growth

The Paris Agreement<sup>1</sup> was adopted at the United Nations Framework Convention on Climate Change in 2015. As a signatory to the agreement, the Japanese government established the objective of achieving an 80% reduction in greenhouse gas emissions by 2050. The use of woody biomass can make a large contribution to the achievement of a low-carbon society (see pages 40, 41), and interest in this renewable natural resource is rising. The Nippon Paper Group, as a comprehensive biomass company, aims to develop ecologically friendly products and promote them across the globe.

R&D is key to that effort. To increase the amount of wood we can harvest per unit area, we are researching the application of cutting and hybridization technologies for trees. We are also developing cellulose nanofiber (CNF) (see page 11), a new material derived from cellulose - a component of wood and the raw material for paper. At the same time, our Cellulose Nanofiber Research Laboratory and newly established Innovative Material Sales Division are working to develop CNF applications. Lignin is another important component of wood and we have devoted significant efforts to using it as a fuel for our in-house power generation facilities and to developing lignin-based products. In addition, we, as a biorefinery, are moving forward with a Japanese-government-led project exploring possibilities for lignin as a raw material.

In the area of paper-based products, we have accelerated the development of ecologically friendly products by establishing the Packaging Research Laboratory and Packaging Communication Center, which performs marketing functions, in 2016. We did this in light of the overwhelmingly positive response to SPOPS® (see page 51) – the world’s first Paper-Pak replaceable shampoo dispenser cartridge – and our new SHIELDPLUS® (see page 52) packaging material with exceptional barrier properties.

As a comprehensive biomass company, the Nippon Paper Group performs R&D that is also valuable for achieving Sustainable Development Goals (SDGs)<sup>2</sup>. New materials can contribute to SDG achievement, but R&D in this area usually requires long periods of time. To accelerate it, we will apply approaches such as open innovation when necessary. We aim to achieve sustainable growth by accelerating R&D and developing new businesses. And it is through the pursuit of R&D with a long-term perspective that we will help to enrich daily life and culture for people throughout the world.

1 Paris Agreement: Multilateral agreement aimed at limiting climate change. Adopted at the 21st session of the Conference of the Parties to the 1992 United Nations Framework Convention on Climate Change (COP21), in December 2015.

2 Sustainable Development Goals (SDGs): 17 global goals with 169 targets. Adopted by over 150 leaders of member states at the United Nations Sustainable Development Summit held in September 2015.



**Kazufumi Yamasaki**

Executive Vice President,  
Representative Director and General  
Manager of the Research &  
Development Division and CSR Division  
Nippon Paper Industries Co., Ltd.

### Relevant Sustainable Development Goals

The Nippon Paper Group can achieve SDGs by successfully implementing its business model. In R&D, work proceeds with the aim of achieving SDGs over the medium-to-long term.



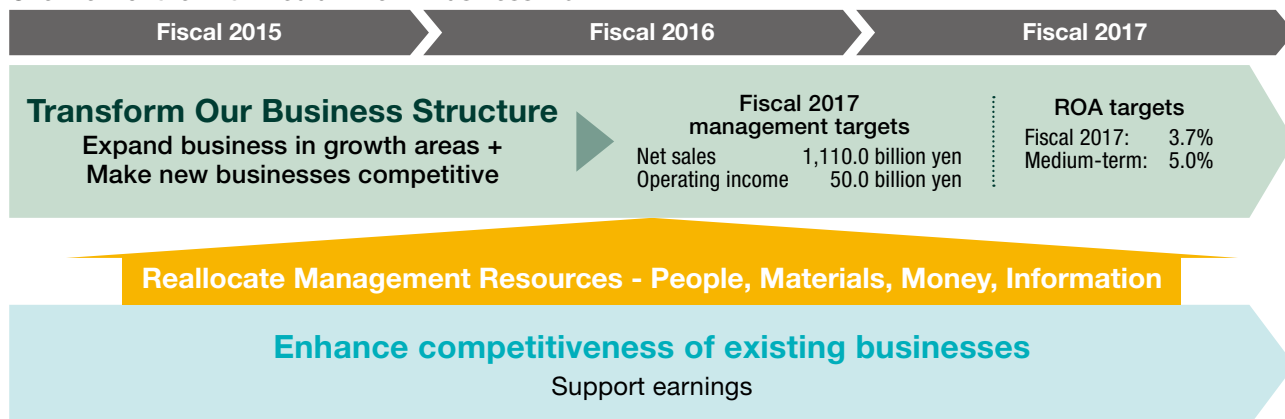
### Main R&D Themes

<p><b>Nurture</b></p> <p><b>Technical assistance to plantations</b></p> <ul style="list-style-type: none"> <li>• Rapid improvement in growth of plantation trees</li> <li>• Genetic improvement of plantation trees</li> <li>• Development of efficient analysis methods for wood properties</li> <li>• Environmental improvement in plantation areas</li> </ul>	<p><b>Sources of Growth</b></p> <p>The Nippon Paper Group's Wood Science Technologies</p> <p>+</p> <p>Nippon Paper Industries' Global Biomass Resources</p> <p><b>181 thousand hectares in total</b></p> <p>( Company-owned forests in Japan: 90 thousand hectares Overseas afforestation areas: 91 thousand hectares )</p>	<p><b>Apply</b></p> <p><b>Biorefinery</b></p> <ul style="list-style-type: none"> <li>• DKP</li> <li>• Fuel by torrefaction</li> <li>• Chemical production</li> </ul>	<p><b>Apply</b></p> <p><b>Cellulose nanofiber (CNF)</b></p> <ul style="list-style-type: none"> <li>• Production technology development</li> <li>• Application development</li> <li>• International standardization</li> <li>• Safety</li> </ul>
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# Implementing the Three-Year Medium-Term Business Plan

Working from a base of enhancing profitability in the domestic and overseas paper and paperboard businesses, the Nippon Paper Group is expanding businesses in growth areas by transforming the business structure.

## Overview of the Fifth Medium-Term Business Plan



## Examples of Results Achieved with Technologies and Assets on Hand

### Growth Areas / New Businesses

#### Energy

- Expansion of wind power, biomass power generation and other renewable energy businesses
- Development of biomass fuels

#### Energy Business

In fiscal 2016, we expanded the Komatsushima Solar Power Plant and the thermal power plant at Suzukawa entered into commercial operation. The wind power generation facility in Akita and the biomass power generation facility at Ishinomaki Hibarino, both of which are under construction, are scheduled to come online in fiscal 2017.



The biomass power generation facility at Ishinomaki Hibarino

#### Chemicals

- Cellulose nanofiber
- Expansion of high-value-added product sales
- Expansion of overseas sales

#### Cellulose Nanofiber (CNF)

In April 2017, we commenced operation of a high-capacity (500t/yr.) production facility for CNF. This facility, located at the Ishinomaki Mill, chemically treats wood pulp to produce CNF with a uniform fiber width of 3 nm. Product development work will focus on creating items such as antibacterial/deodorizing sheets, transparent sheets, paint additives, and other industrial products.



High-capacity production facility for CNF

#### Healthcare

- Expansion of light incontinence product sales
- Expansion of overseas sales

#### Healthcare

The Poise® Hada Care Pad and the Hada Care Acty® series - CNF products with high deodorizing capacity - respond to the needs of an aging society. Going forward, management resources will continue to be directed toward the healthcare business, which is expected to continue growing.



Poise® Hada Care Pad

Hada Care Acty®

#### Packaging

- Refinement of liquid carton designs
- Closures attachable

#### Liquid Cartons

Pure-Pak Curve, a new type of paper carton with a resealable closure, was adopted for use by the manufacturer of a major brand of fruit juice. Sales of these products in Pure-Pak Curve containers began in March 2017. As Japan's largest total system supplier of liquid cartons, we are committed to moving forward with the development of more new products.



New type of paper carton with a resealable closure